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THE ELECTRIC POLE NUISANCE.

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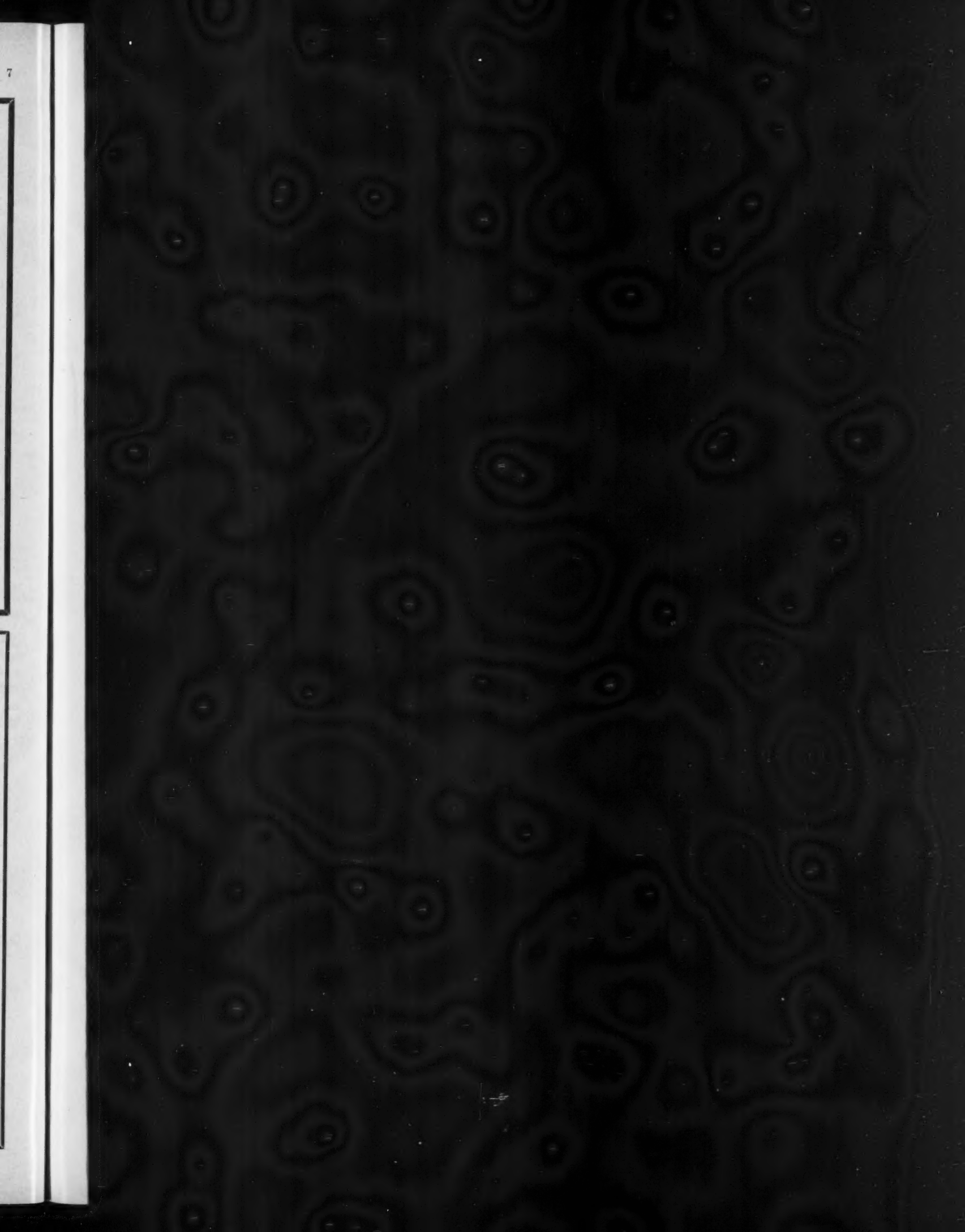

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MOUNTAIN KING MINING COMPANY POWER PLANT

BY RUDOLPH W. VAN NORDEN.
Mem. A. S. C. E.; Fel. A. I. E. E.

There are probably many mining prospects in California which give evidence of extensive values and which could be developed into gold producers of importance, if it were possible to obtain cheap power in sufficient quantity. These are the low-grade ore bodies which must be developed and operated at low cost per ton of ore. Such properties may be found in all stages of development, from a mere hole in the ground, to old properties containing miles of workings with costly plants, long records of money poured in, but with little to show on the right side of the balance sheet, where profits and dividends should be. The possibility of power application through electric motors, wherever it may be desired, after the plant has been designed for high efficiency, a minimum of lost or needless motion, and a centralization of operations, can make possible the commercial development of the prospect, or turn the producing failure into a bonanza.

It is possible now to transmit electric power into many of the mining districts, and will become more and more so as the power companies grow and expand, but there are hundreds of such properties to which the power lines of the transmission companies may not reach, and to these the solution of the power problem presents itself as the principal means of existence.

About a decade ago a company was formed to develop a mine in a mountain which rises out of the canyon of the Merced River, not a great distance below the gateway of the Yosemite Valley, in Mariposa county. This canyon was uninhabited and almost inaccessible. There were no roads within a dozen miles of the locality and the occasional miners' trail was almost a figment of the imagination. Here, aside from promising outcrops and good prospects, was the possibility of water power from the Merced River, for the river, at this point has considerable grade.

Mountain King Power Plant and Suspension Bridge.

A tunnel was started into the mountain side, 800 ft. from the river, its portal being at the bed of a ravine about 2000 ft. above the river. To obtain the water power at the mill and at the same time, to place the mill as near as possible to the mine, it was neces-

sary to locate the mill on the river bank and at the mouth of the ravine. Below the site of this mill the river bed falls 100 ft. to the mile where it passes through a gorge, but above the millsite, the fall is much less, being but 40 ft. in two miles. As it was necessary to deliver the power from a water wheel directly to the shafting in the mill, it was necessary to utilize the fall in the river above the mill. With this plan in view a wide and low, log and gravel dam was built, together with a wooden flume about two miles long. By the time this flume had reached the mill, the available head in the penstock was but 24 ft. About 75 h.p. was obtained by this means, enough to drive a ten-stamp mill and small air compressor. So far this was good, but the mill was of necessity at the river's edge almost a half mile from the mine entrance. This required transporting the ore, first in cars out of the mine, then a transfer to a second car system operating on an inclined tram to the mill. This tram was of the balanced car type. As an ore transporting system of small capacity it was the best arrangement possible, but of little value for carrying lumber and supplies from the mill to the mine.

Soon after the mill was placed in operation, the Yosemite Valley Railroad was built up the Merced River. This line passed close to the mill and a station was established there. Development within the mine gave a new portal at a lower level than the earlier workings, and, while this entrance was in the bottom of the canyon 1000 ft. from the mill, it was in altitude but 300 ft. above it. A new inclined tram was built, but aside from a smaller drop and a shorter line, it possessed all of the disadvantages of the first one. The development had been, so far, sufficient to keep the ten stamps going, but to keep ahead of expenses it was necessary to add more stamps and more power.

In 1910, a battery of 20 stamps was accordingly added and a 50 h.p. distillate engine installed.

Between the high cost of power and the inefficiency of the transportation system between the mine and mill, the property was closed down in 1912. Late in 1913 the company was reorganized, new money introduced and the mill again started. While the ore values were present the power problem had not improved; the old timber flume was almost at the end of its usefulness and the entire property was rapidly disintegrating. By frugal operating, it was possible to pay expenses and the mill was run in a small way. It was readily seen that a successful future was possible only by installing a modern plant, making every possible economy and above all after such a plant had been designed and constructed, to have ample power available. These needed improvements were all impossible with the old plant and waterpower.

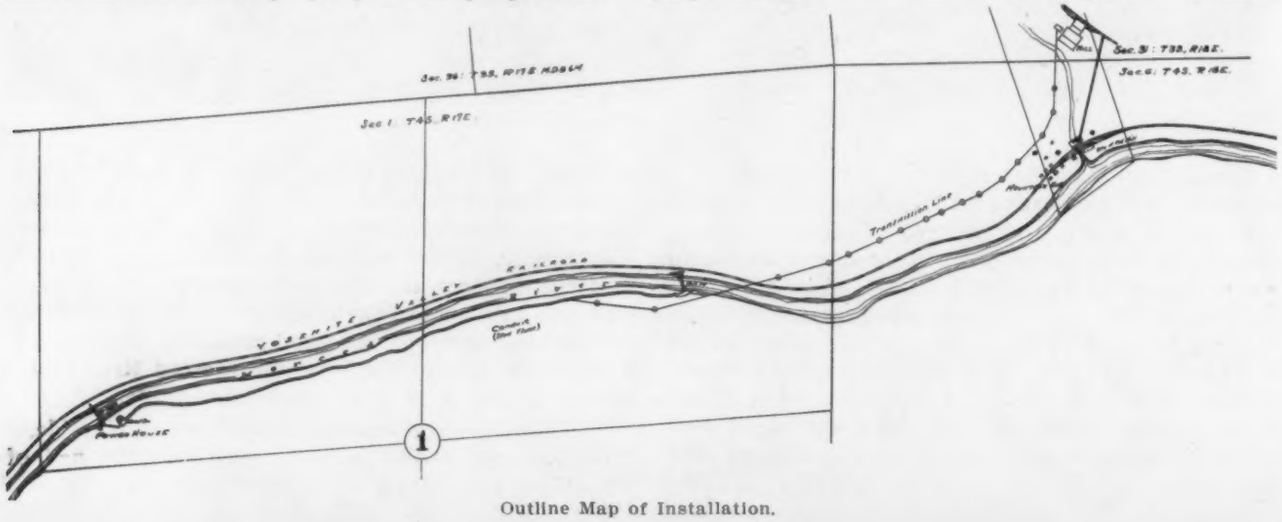
To install a new plant meant a large expenditure of money, which must be raised, either by making the old mill produce it, or by assessing the stockholders. The first method except in a small way was out of the question, the latter a tedious and difficult undertaking and impossible except within comparatively narrow limits. To obtain power from the nearest existing line required the construction of a transmission line over rugged mountains a distance of about 15 miles. But the possibility of developing sufficient power in the rugged canyon below the old mill was attractive.

At this point, in August, 1914, the writer took up the study of the problem of power development and a new plant which would be capable of treating all of the ore that the mine could produce and embrace every possible economy. Low first cost was an absolute essential and low operating cost a necessity, otherwise the property would have little commercial value. The result of this study was the designs for a power plant, milling plant, mine railway, etc., by the writer, and construction of the work by contract under the personal supervision of the writer. The power plant is described in the following pages:

Dam.

A reconnoissance survey was made in that part of the canyon below the old mill where it appeared that the most economical and efficient plant could be located, where sufficient power might be obtained to operate the mining plant both for present needs or for any future requirement and where designs of the various parts might be employed in the construction in which the cost would not be outside of the financial resource of the company.

The survey, which was entirely on Government land outside of the Forest Reserve, disclosed a number of relatively difficult problems, due to the heavy angle of slope of the canyon side, this varying from perpendicular cliffs at the river's edge to a minimum



Outline Map of Installation.

slope of 40 degrees with the horizontal somewhat above the high water line. This condition was accentuated by the extreme hardness of the bedrock. Other conditions to be met were the great difference in elevation of the river's surface between low water and high water, under the latter condition the river becoming a raging torrent. The further fact that the location of the Yosemite Valley Railroad on the north bank of the river, which at some points is scarcely above the high water level, precluded the possibility of locating a diverting dam which would, under high water conditions, raise the river above the natural level and thus menace the railroad. To construct a low diversion, operative during low water by an adjustable crest, meant a low elevation for the conduit, which if so placed would be actually submerged during the high water period for a considerable part of its length. A good location for a dam was found about three-quarters of a mile below the mill, where the bottom consisted partly of bedrock and partly of large boulders firmly imbedded; in fact, these rocks formed a sort of natural dam which made a fall in the river of about 4 ft. The writer determined to build here a reinforced

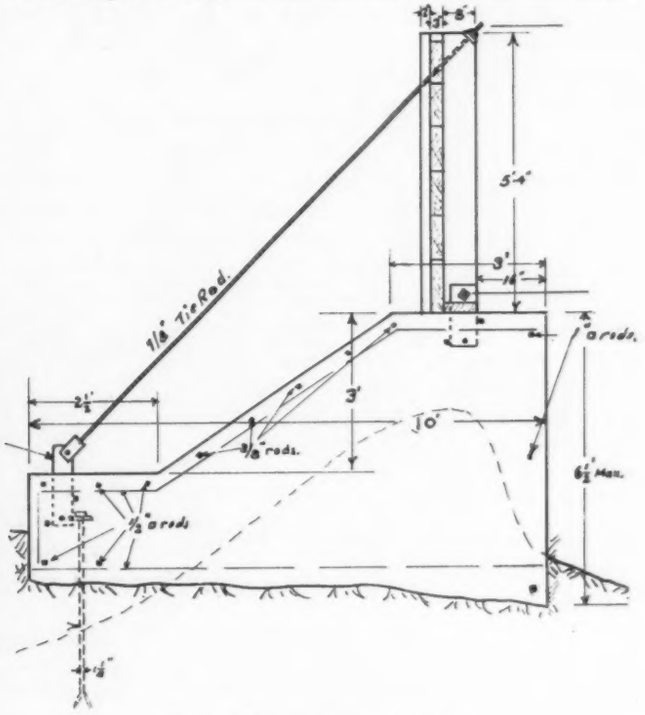
The Dam, showing Part of Flashboards in Place.

concrete gravity dam incorporating therein a part of the rocks of the natural dam and anchoring as much of it as was possible to bedrock. The crest to be only slightly higher than the original rocks. By this means an easement was provided which would offer actually less obstruction to flood flow than did the original rocks, and hence, would not raise the water level to menace the railroad.

For low water flow conditions a system of flashboards was adopted which could raise the pond formed by their use to a sufficient height for entrance of the flow into the canal. A wing wall at the south end of the dam was built for diverting the flow and this wall was carried for a distance of 200 ft. to form a canal which was otherwise excavated out of the sidehill. Near the end of this canal the excavation was carried through a projecting point of bedrock and here a natural deflector was formed to turn away the force of the river when it is high enough to submerge the canal, and in this cut is a pair of diagonally placed head gates. The canal wall acts also as a wasteway. The north end of the dam terminates in an end wall which continues upstream and into the bank as a diagonal deflecting wall. The downstream end of the endwall terminates in a heavy buttress to carry all downstream and end strains. The space behind the endwalls is filled with rock and decked over so that high water will pass over without causing damage.

Work on the dam was commenced October 10, 1914, on the south half of the dam proper, allowing the river flow, which varied from day to day, from 150 to 300 second feet, to occupy the north half. Sandbag cofferdams were built to keep out the water where the work was proceeding. In placing the concrete in the south half, a notch 12 ft. long and 3 ft. deep was left open to allow the flow to pass while working on the north half.

The dam was designed as a solid beam, 88 ft. long, averaging 6 ft. high on the downstream side and about



Typical Cross Section of Dam.

3 ft. high on the upstream side. The lower face is vertical and the upper face has a gentle slope from the average bed of the river above the dam. The dam was reinforced longitudinally and transversely in both faces and on top so that, in case there should by any possibility be a washout under any of the part not on bedrock, there would be no danger of rupture or deformation in the dam. This precaution was taken notwithstanding that the dam is at all points below the natural bed of the river. Reinforcement was also calculated to withstand any twisting strains which might be set up in the event that a flood should overtake the dam when the flashboards were in place.

In designing for stability, the possibility of full uplift pressure was considered when the head of water was three feet over the top of the flashboards which is the point at which they are designed to fall and wash out. Aside from its natural stability, about one-half of the entire length of the dam is anchored to bedrock by heavy steel wedge anchors placed near the upper toe.

In building, a 1:2:4 cement, coarse sand and crushed rock concrete was used to a thickness of two feet in the upper and lower faces and the deck, making a sort of box section, while the filling consisted of the same grade of concrete, but freely filled with plums as

large as two men could carry. The end walls are reinforced for flood strains and are thoroughly tied in with the main crest.

The flashboards are made of 3 by 10 in. Oregon pine lumber, surfaced on one side and two edges. They are 5 ft. long and when all are in, raise the water above the crest 5 ft. 2 in. The flashboards are supported between 6 in. by 13 in. posts, grooved to receive the boards. These posts are hinged at the bottom by a bolt which passes through the post and is held by a chair of two ½ in. by 6 in. plates which extend into the concrete and are tied into the reinforcement. This arrangement is made so that the post may swing forward when the flashboards are out and thus lie down, or, in case high water should carry away the flashboards, the posts would not be lost. The upper end of the posts are held by ¾ in. rods which tie into heavy steel anchors imbedded in the concrete and tied into the reinforcement in the upper face of the dam. The ends of these rods were turned down to a ⅝ in. diameter from the holding nut and washers. The diameter at the bottom of the thread is ½ in. With water at the top of the flashboards, the factor of safety is 4, but should the river rise 3 ft. above the top of the flashboards, the rod will break at the nut, allowing the post to swing forward and the flashboards to wash out. The three end panels at the north end of the dam have double posts and the boards are spiked on. These are intended as emergency flood gates. They are held in place by heavy yokes which in turn are held by a clevise and coupling pin to the strain rods. In the event of a sudden rise in the river these pins may be pulled out and the gates can then lie down and relieve the water sufficiently to allow the removal of flashboards.

To facilitate the removal of flashboards, or to clear the dam of trash during high water periods, a ¾ in. plow-steel cable has been suspended across the river directly over the line of flashboards. A small, "flying Dutchman," or car hung from two trolley wheels traverses this cable.

Flume.

At the end of the entrance canal and 200 ft. below the intake the flume commences. This flume is interesting from the fact that every post is solidly anchored to bedrock and the flume may be submerged without danger of losing its alignment; also, that any section may be taken down and replaced in a few hours in the case of rock slides which might menace the structure; also, that it is very crooked, notwithstanding the fact that it appears to be quite straight to one observing from the railroad across the river.

The flume has a total length of 3737 ft. A more difficult location for a water conduit would be hard to find, as, with the exception of the last 600 ft., the supporting ground consists of water worn cliffs and jagged promontories of hard rock. To have followed the contour of the ground would have been impossible and the final location and attendant height was a compromise between the cost of lumber and the cost of benching out the rock promontories. Much blasting was, of course, necessary and this required hand drilling, which in itself was expensive, due partly to the extreme hardness of the rock and partly because of inaccessibility, for, in many places it was necessary for the driller to be suspended from a rope fastened above the cliff.

The unit costs in the construction of the flume, compared with similar flumes in a less difficult location, were high, notwithstanding that the utmost economy was exercised and the closest supervision given to all features of the work. These costs can probably be taken as a maximum for flume of this character in most difficult locations and, at that, are considerably less than an all wood flume of good construction and equal carrying capacity would have been.

The following is a brief segregation of costs per lineal foot of flume in place.

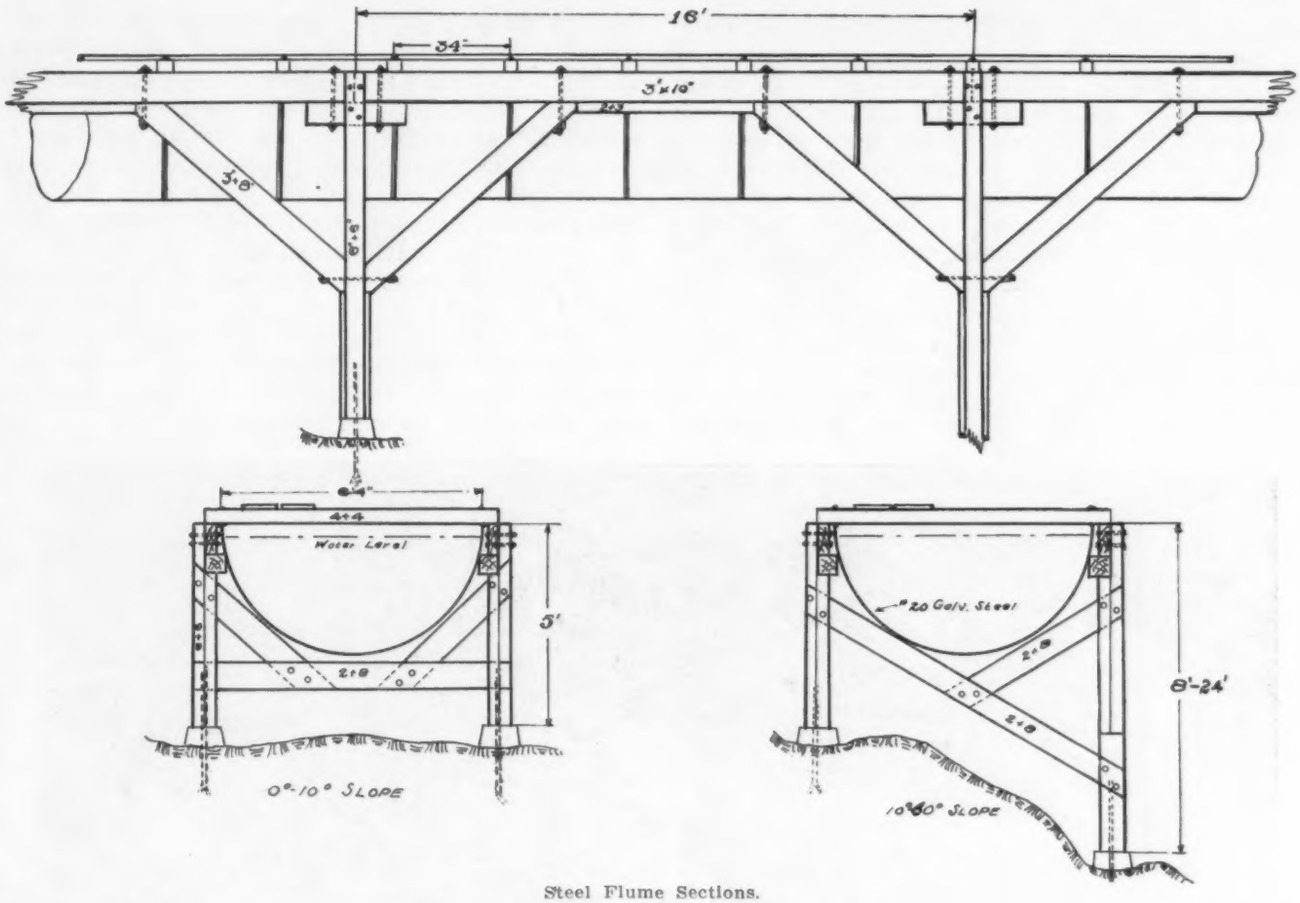
Rock excavation	$ .45
Post hitches and holes, and placing pins	.157
Lumber: Total amount, 96,480 ft. B. M. Per lin. ft. 25.75 ft. B.M.	
" Cost on cars delivered, at $22 M. B.M.	.568
" Cost transporting to place of use	.145
" Framing, at $29 per M. B.M.	.747
Bolts, washers and lag screws	.182
Flume steel, delivered	1.60
Flume steel, transporting and setting up	.185
Surveying and overhead	.094
Total cost of flume per linear foot	$4.128

A crew of four men and a straw-boss was found to be most efficient in placing the steel sheets and, due to the height of structure, falsework was required throughout the length of the flume. This was constructed by the steel crew as they progressed. The average daily progress was 98 lin. ft. of flume.

Cost of carpenter work varied between $15 per M. ft. B.M. for setting up posts, to $46 per M. ft. B.M. for cutting and fitting stringer braces. The overall cost was $29 per M. ft.

The flume is made of No. 20 gauge galvanized steel sheets, 36 in. wide and 12½ ft. long. It was furnished by the Hess Flume Co. of Denver, Colo. The form is semi-circular and the diameter 6 ft. 4 in. The gradient of the flume is 0.1 per cent, or 5.28 ft. per mile; the nominal carrying capacity is 82 cu. ft. per second, equal to 3280 miners' inches.

The steel sheets have depressed "S" grooves rolled into both longitudinal edges, the grooves on one side being slightly deeper than on the other so that adjoining sheets fit snugly without a projection on the inside edge of the flume. After being fitted together a flat steel bar with beveled edges, rolled to the same curve as the sheets is laid in the grooved joint. This bar is 3/16 in. thick and its upper side is flush with the inside surface of the sheets. The bar has a twofold purpose; it forms a smooth surface at the joint for an even water flow; it also acts as a backing against which the joint may be drawn thus making a watertight joint. The ends of the bar rest against a wedge shaped malleable iron chair, or stop, placed on the under side of the cross timbers which carry the flume. Around the outside of the joint is a ½ in. round steel carrier rod which passes through the chair and also the cross timber and terminates in a washer and nut on the upper side of the timber. The carrier rods carry the weight of the flume and its load and by means of the nuts is tightened, thus drawing up the joint against the inside bevel bar. In the construction and setting up of the flume, the sheets were shipped from the steel mill flat with the grooves already in. Both the sheets and bevel bars were rolled at the point of unloading. It is impossible to make the slightest



Steel Flume Sections.

curve or change in direction by bending or straining the joints in this flume and as there were many curves to be installed a simple plan of procedure was followed: In making the final location of the flume all curves were made at support points which were nominally 16 ft. apart. These curves were laid out to have angles of departure of 2½ degrees or multiples thereof. The total curvature was found and a proper number of sheets were tapered on one side so that when rolled the tapered side would bear the desired angle. These tapered sheets were made partly with a 2½ degree taper and partly with 5 degrees taper. This arrangement for making curves was found to be satisfactory and, aside from taking slightly more time in setting up the sheets was handled in the same manner as was the straight sections. As each sheet was about to be placed into position, the joint was well swabbed with asphalt paint. This served to insure a watertight joint and also to prevent rust in either the joint or the bevel bar.

The flume superstructure is supported by posts, nominally 16 ft. centers. These posts are 6 by 6 in. Oregon pine lumber, the outer posts averaging 16 ft. length and the inner posts about one-half that length. In placing the post, its location was carefully determined by the surveyor with the idea of preserving strict alignment of the flume. Posts in all cases were placed on bedrock after the latter had been moiled to a level hitch. A 1 in. diameter vertical hole was first drilled into the bedrock 10 in. deep and a ⅞ in. iron rod, 2 ft. long was driven into the hole and wedged tightly. A similar hole was bored with the grain, into the bottom of the post, and the post was then straightened up and driven home over the standing iron dowel. The bottom of the posts were treated with carbolineum and then a cement grout was run under the post to give a true setting. This method of anchorage was found to be sufficiently secure to withstand any upward strain which might be brought tending to dislodge the flume or posts. Every post throughout the length of the flume was anchored in this manner. The tops of the posts were framed into a carrier timber, 4 in. by 6 in. by 3 ft. long, except at angles when this career was cut from 6 by 6 in. material. These carried the stringers which are 3 in. by 10 in. by 16 ft. long. The carrier is bolted to the post as are also the ends of the stringers, while the latter are bolted downward through the carriers. The knee braces cut from 3 in. by 8 in. timber, were carefully framed to the posts and bolted through the ends of the stringers and posts respectively. A 2 in. by 3 in. batten spiked to the under side of the stringers served as a butt piece between the adjacent ends of the knee braces, while 2 in. by 6 in. butt pieces were spiked to both sides of the posts and extend from the bottom of the kneebraces to the base of the post. Outside of the butt pieces all joints in the substructure are bolted together. On one occasion, when a large rock slide threatened to carry away the flume, the structure was unbolted, the sheets removed, the loose rocks started downward to the river through the gap so formed, and the flume section was replaced all in the period of a few hours by a couple of men.

During the period of high water, the first 1000 ft. of this flume might be submerged, partially or wholly. At exposed points where heavy floating debris might strike a post and break it, double posts have been in-

stalled and these are battened together to further resist a blow. Where the span between posts was greater than 16 ft., and not over 20 ft., 4 in. by 10 in. stringers were used and a simple truss, 3 ft. deep was constructed to further strengthen the span. Where the span is over 20 ft. the stringers are made of three pieces of 3 in. by 12 in. lumber spiked together and a two panel truss added on each stringer. At a point about 1000 ft. below the intake is placed a steel wastegate.

The flume terminates in a timber headbox. This is 24 ft. by 8 ft. by 8 ft. inside. In this are placed three galvanized steel waste gates 30 in. square. Beyond the wastegate is a sand barrier extending 2 ft. above the floor of the box and from the top of this barrier and sloping backward at a 1:1 slope is a wooden bar grizzly covered with a ½ in. mesh galvanized wire screen. The front side of the headbox is cut below the level of the top of the flume and acts as a waste wier. With no water passing to the power house and a full head entering from the flume, this waste wier will discharge the entire flow. With the power house using all of the water, the water level stands at the crest of the wier, hence giving automatic regulation.

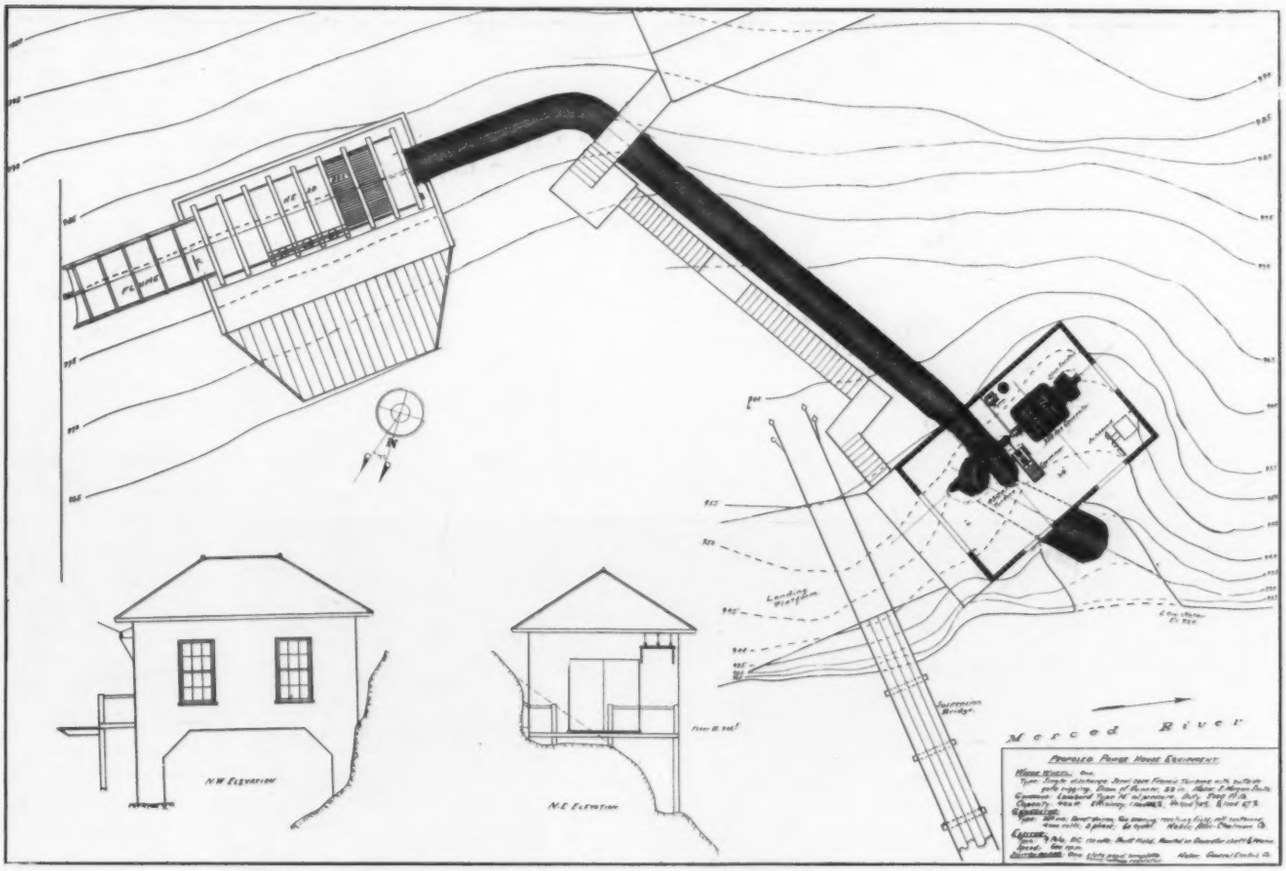
The headbox was, of necessity, built at a point where the entire mountain side is an ancient slide, and while of very compact boulders and earth, there is probably no bedrock close to the surface. To prevent the danger of dislodging the headbox, caused by leakage or overflow, a reinforced concrete apron with low walls on three sides was laid in the bench excavation. This apron was carried down the natural slope for 6 ft. and terminates in a long wooden apron which carries the overflow away from the hillside. The headbox is mounted on posts which in turn are placed on sills on the concrete apron, the whole structure being thoroughly braced. The penstock, which is a redwood stave pipe, 4 ft. inside diameter, enters the end of the headbox opposite to the flume inflow. There is a short horizontal section terminating in a riveted steel elbow in which the composite horizontal and vertical angle is 67 degrees, from this elbow, the stave penstock continuing to the power house is perfectly straight. It is supported on reinforced concrete chairs every 12 ft. with more or less backfill between the points of anchorage. The lower end of the pipe terminates in a steel taper 6 ft. long. This taper piece is anchored in concrete and at its lower end, after passing through the rear wall of the power house building bolts directly to the scroll casing of the turbine.

Difficult Flume Construction.

Power House.

The power house is placed on a sheer porphryte wall at the entrance of a box canyon. The river at this point is narrow and the flood water line as high as twenty feet above the low water flow. The problem presented here was to place the machinery and the floor level of the building above the point of highest water, and, at the same time with a workable draft head to low water, so that the full fall could be utilized at all times. It was also necessary to have a solid foundation for the machinery, and yet, not desirable to carry the building foundations into the river to obstruct the flood water flow. This condition was aggravated from the fact of the extreme hardness of the bedrock, making bench excavation difficult and costly.

The power house, while ample in size, and arranged for utmost convenience of operation is 24.5 ft. long and 16 ft. wide, inside measurement. The bedrock was benched for the length of the building to a width of about 9.0 ft. On this bench, with its axis parallel to the length of the building, was placed the single generating unit. At the two forward corners of the building are two heavy reinforced concrete columns whose reinforcement is carried into bedrock, and which are tied by heavily reinforced walls back to the bedrock at the floor level. Across the front of the building and supported on the two columns is a reinforced concrete beam which carries one side of the suspended floor and the front wall of the building. The power house floor is a single reinforced concrete slab, 6 in. thick. The walls of the building are 2 in. by 6 in. timber studs spaced 12 in. centers and these are covered outside and in with herringbone metal lath, which, in turn is plastered with a 3:1 cement plaster,



Plan of Power House Layout.

there being three coats and pebbledash finish on the outside and two coats with float finish on the inside. The roof trusses are of timber and are covered with No. 24 gauge galvanized corrugated iron. A stamped sheet steel ceiling is suspended on the lower chords of the roof trusses. With this construction the building is practically fire proof inside and out. A simple I-beam travelling crane of 4 tons capacity was provided.

The generating unit consists of a Francis scroll-case turbine, direct connected through a bolted flange coupling to a 350 k.v.a., 3-phase generator. The generator shaft is extended at the further end to carry the armature of the exciter which is mounted on a castiron shelf bolted to the base of the generator.

The turbine has a capacity under maximum head of 450 h.p. The entrance of the scroll case where the taper from the penstock bolts on, is 36 in. diameter. The scroll is built up of ¼ in. steel plates carefully shaped to preserve the hydraulic curves. The upper and lower speed rings are thoroughly bolted to the inner rims of the casing and are bronze lined and bushed to carry the gates. The gates are cast steel, carefully finished and are carried on steel pins which extend through the upper speed ring and to the ends of which are keyed the bellcranks which in turn are connected through breaking links with the shifting ring. The gates are balanced to have a closing tendency above quarter load. The runner has a nominal diameter of 21 in. and is made of curved steel plates about the ends of which are cast the hub and rim. This runner is of a high specific speed type, the specific speed being 80 and the speed factor 87. Water after leaving the runner enters a quarter-turn which discharges into a conical draft tube 24 ft. long having an outlet 5 ft. in diameter, and which is made of sheet steel plates ¼ in. thick. To overcome the hydraulic thrust of the runner, the shaft is carried through the quarter-turn into a "Gibbs," thrust bearing. This consists of a flat disc at the end of the shaft having a babbitted face which bears against a similar castiron plate in which are cut four radial grooves. The stationary plate has a spherical bearing on its back and is carried by the castiron cap and enclosing structure which bolts to the quarter turn. The weight of the thrust-bearing is carried by a hollow pedestal which acts as an oil reservoir. The oil contained therein is constantly pumped by the motion of the disc and the aid of the four radial grooves between the faces of the discs. A cooling coil through which water from the penstock circulates is placed in the pedestal to keep the oil cool. Placed between the turbine and generator and extending forward into the operating space is a type M, 5000 ft. lb. Lombard governor. The connection between the governor piston and cross-head is direct through a link to a lever on a rocking shaft and from which the push and pull rods move the gate shifting ring. Placed in the rear of the machines is an oil pump and reservoir, the former being driven by belt from the hub of the coupling between the turbine and generator. The entire operating mechanism is well balanced and moves with great ease and the automatic governing is remarkably satisfactory. The turbine and governor connections were built by the S. Morgan Smith Co.

The operating head varies from 63 ft. at low water to about 50 ft. in flood periods.

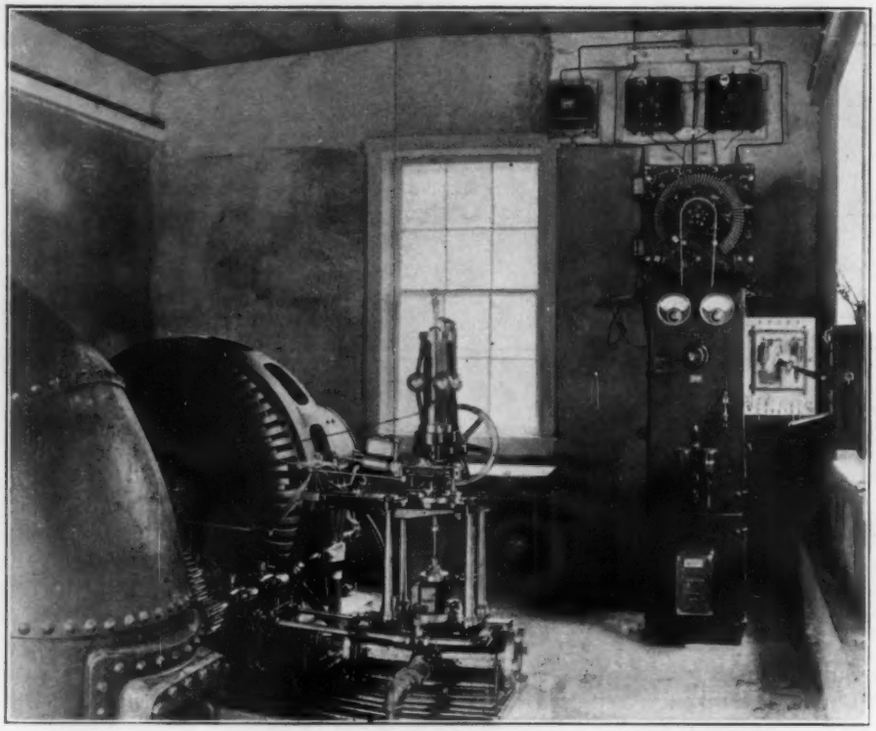
The generator is of a standard type with two pedestal bearings. It delivers 3-phase current at 4000 volts and is rated at 350 k.v.a., with 40 degrees temperature rise in the armature at rated load.

The exciter is rated at 7.5 kw., and has four poles which are shunt wound. An outboard bearing carries the end of the exciter shaft. The unit is driven at 600 r.p.m. The generators and also motor equipment at the mill and the transformers were furnished by the Allis-Chalmers Manufacturing Company.

A single black slate panel switchboard is equipped with ammeter, voltmeter, integrating poly-phase wattmeter, Tirrill regulator and outgoing automatic overload oil circuit-breaker. This is ample apparatus for complete control as there is but the one outgoing circuit leading to the mine.

danger of high water in the river getting close to the wire, the line leaves the flume and is carried on structures on the hillside to a point where a span 900 ft. long is made across the river. On this span the wires have a spacing of 6 ft., and to prevent the possibility of swinging together, as the result of winter winds which sweep down this canyon, the span is given a one-quarter turn so that the wires can never touch each other. From the north side of the river the line is carried on poles to the transformer station at the mine.

There are three 100 k.v.a., 4000 to 440-220 volt oil immersed and water cooled transformers. These are mounted in a small corrugated iron ventilated structure. Both primary and secondary are delta connected. All motors are 440 volts while the camp light-



Interior of Power House.

The power plant is self regulating and requires but occasional attendance, the only difficulties in continuous operation being the filling of the screen in the head-box with trash, which requires more or less attention.

Notwithstanding that the load consists almost entirely of induction motors from 3 h.p. to 100 h.p., there being at present eleven in use, aside from a locomotive for hauling within the mine, both the speed and voltage regulation are practically perfect and light service could scarcely be improved.

Transmission.

The transmission line has a length of 8700 ft. It consists of three No. 4 medium hard-drawn copper wires carried on 3 petticoat porcelain insulators and wooden pins. For a distance of about 3000 ft. the transmission is supported on long arms mounted on the flume structure so that the wire is in the clear over the river. At the point where there would be

ing circuit is 220 volt, 3-wire, 3-phase. This is obtained by taking one leg from a delta lead and the other two from the middle points in the winding of the two adjacent transformers.

The locomotive, is driven by two 5 h.p., 220 volt a.c. repulsion type motors. In order to obtain the current for the trolley, the middle point of one of the transformers from which is also taken one of the lighting leads, is grounded and this connection is also connected with the rails which are bonded. The other terminal of the 220 volt railway circuit is taken from the outside of the same transformer winding, but opposite to the end supplying one of the lighting legs.

The cost of this power installation including preliminary surveying, dam, canal, power plant, transmission and transformers, and overhead expense and engineering was $35,169. The plant will deliver 400 h.p. to the mill at all times, which makes the installed cost per horsepower delivered, $88.

THE ELECTRIC POLE NUISANCE.

BY J. E. MacDONALD.

(After showing how the pole nuisance had been minimized in Los Angeles this paper brings out the fact that a competing municipal system, with its duplicating equipment, brings back the trouble. The paper was recently read before the Los Angeles Jovian League. The author is secretary of the Joint Pole Committee at Los Angeles.—The Editor.)

The greatest evil in the electrical industry today is the pole nuisance. It is a necessary evil, but none the easier to tolerate on that account. There are almost 100,000 poles in Los Angeles and the only hope that we may ever be relieved of this nuisance is that the requirements of every household will increase and so intensify the demand that funds may be provided for placing all wires underground in the urban districts. This possibility is so remote, however, as not to be pertinent at this time. Indeed, we shall do very well in this city if we can find some way to maintain the distributing systems as at present without the duplication of poles which is contemplated by the municipality, and which promises to increase the number almost fifty per cent.

The enunciated principles of all public service regulating commissions include the unwritten law that prohibits plant duplications where adequate service is being given at reasonable rates. In Los Angeles there is a perfectly adequate system for the distribution of electricity for light, heat and power. Rates and service are regulated by a state commission of competent authority, which ensures the lowest possible rates with perfect service. In addition to this, overhead lines have been erected on joint poles so as to reduce the pole nuisance to a minimum. In this respect, it would seem that conditions are as near ideal as possible from the consumer's standpoint. Duplication of facilities does not exceed five per cent, and this largely represents main feeder lines or construction erected many years ago, before the futility of useless duplication was recognized. The practice now is for each company to develop certain territory fully and not to construct lines in localities already adequately served by another company.

It has not been considered expedient in California to empower the railroad commission with authority to fully protect the corporation as well as the consumer. It may prohibit one corporation from paralleling another in any given territory, but it may not interfere with the municipality, which may adopt the "rule or ruin policy" with apparent impunity, thus inducing greater evils than private ownership of public utilities without any control or regulation whatever. This policy offers a menace, temporarily at least, to the existing companies.

The inability of the city, however, to recognize rights granted temporarily to private enterprise, and failure to safeguard the investments which have been made in good faith, places the interests of every citizen in jeopardy and tends to make the community a place to be shunned by the prospective investor.

The law of compensation knows no individual, corporation or municipality. It is always positive in its action, as some of you have no doubt experienced. An attempt to get something for nothing carries with it at all times the assurance that you are about to get nothing for something, and that is the exact situation in Los Angeles today. The municipality is on record as seeking to condemn, without proper compensation, a portion of the system of the Southern California Edison Company.

For eight years municipal light and power has been known to be a prospective commercial commodity, which must be disposed of at a profit. Had there been any well defined policy or plan of action, such as governs the privately-owned utility, contracts would have been executed long ago for the entire output. Had there been any real desire to purchase a portion of the systems of the Southern California Edison Company, the Pacific Light & Power Corporation, or the Los Angeles Gas & Electric Corporation, the negotiations to effect such result need not have required eight years of delay or any useless litigation.

Some of you no doubt recollect the several propositions submitted to the city over two years ago by the companies. Without going into detail, it should be noted that any one of these propositions offered a positive solution, which included all the essentials of public ownership and control, and which would ultimately have developed into full and complete ownership for the city, without injury to the existing investment of the companies. These propositions were given such slight consideration that it is apparent a duplication of systems had been predetermined.

Under the circumstances, it is safe to predict that the year 1916 will give us a great object lesson in negative co-operation. Municipal pole duplication is about to re-create the same pole nuisance that existed several years ago, before the companies adopted the present co-operative method of using facilities jointly. This is a matter of vital interest to every member of this league and to every other home owner in this city.

For almost a decade the companies have consistently endeavored to suppress the pole nuisance. How well they have succeeded, is best shown by the fact that 70,000 more poles would be needed for the service given today had the companies not initiated the joint pole scheme, which, aside from the relief of the annoyance to the property owners, has helped to give Los Angeles the most favorable rates of any city of its size in the world. This work is still going on at a normal rate which saves in excess of 1000 poles per month. This saving represents the conservation of many acres of natural forest, which we trust may be put to better uses by posterity.

Over fifty per cent of the distributing lines are located on the rear property lines or alleys. This percentage would be even greater were it not for the fact that it is necessary to maintain many poles on the streets for street lighting purposes, and this being the case, distributing circuits have in many instances been placed on the same poles.

This is the problem which will confront the city also. It will be necessary for the city to build an entirely new street lighting system, and its distributing lines will therefore also be confined largely to the streets. Forty-five thousand poles will be required to adequately cover the city of Los Angeles so that every citizen desiring municipal light and power may be served. This represents an investment for poles alone amounting to over $900,000. It will cost you and every other member of this league $5 for the privilege of having another pole in front of your residence; it will cost you annually over $1 to maintain that pole

in position, and this applies to every other home owner in Los Angeles.

Compare this result with the economies which have been brought about by joint construction. Every time two, three, or four companies join in the use of a common pole, the investment is divided into two, three, or four parts, as the case may be, and the fixed charges are similarly divided so that the consumer derives the full benefit of freedom from unnecessary duplication and useless waste.

The present joint lines have been erected in accordance with the regulations of the railroad commission and the statutes of the state of California. Lawful clearances have been established for the facilities now in use. Joint construction with the city is impracticable, due to the great cost of reconstructing lines which now conform to law. Higher poles would be necessary in all cases. Notwithstanding this, the city will be to great expense in obtaining its legal clearances from existing lines. This is the most difficult problem which the companies have to contend with today. The construction of another distributing system under such conditions is a task which even a private corporation would hesitate to initiate.

The 45,000 poles required for municipal distribution will have to be replaced by a like number in from ten to fifteen years. Including maintenance, interest and depreciation, this represents an annual charge of over $150,000, which is part of the price the citizens will pay for pole duplication alone, and that is not all. This does not include the crossarms, wires, cables, transformers and fixtures which go to make the sky line of our city hideous.

No logical reason has ever been advanced to support the necessity for this reckless expenditure of public funds derived from a bond issue, which a future generation will be called upon to pay. The public service companies in Los Angeles have been the greatest factors in upbuilding the community. For many years, millions have been brought into Los Angeles for the development of public utilities, and so far, there has not been any compensation for those who have made this possible. That such funds are no longer available for developing the wonderful possibilities of our city and country, is due entirely to the accurate impression which has gone abroad that we are indifferent to the welfare of the investor. Hailed as a benefactor until his funds are irreparably tied up in California industries, he thereupon becomes a malefactor seeking unmerited compensation.

The electric railways of Southern California are recognized as the greatest in the world. Serving a population of less than one million, they have been striving to give us service not excelled in communities with ten times the density of population. Their promoters have built far into the future, and it is due to those who have demanded constant restrictions on the railways that withdrawal of service is gradually taking the place of development. Automobile competition is further curtailing income, taking the choicest business without assuming any share of responsibility to the community as a public utility.

The power and telephone companies likewise have penetrated the remotest sections of this community, so that service is available to a large percentage of the citizens in the city or country.

A curious analogy exists between the jitney bus competition with the railways, and municipal competition with the power companies. The jitneys are taking away the cream of the railway business, and yet it is conceded on all sides that they are operating at a loss. An entire ignorance of economic principles succeeds in maintaining the loss making competition through constant change of ownership of the jitneys. The city will share the light and power business with the power companies, and will be operated at a loss in that it cannot provide for maintenance and depreciation and at the same time take care of its interest and sinking fund requirements, so that the difference will have to be made up by direct taxation. Experience elsewhere has proven that where the municipality enters into competition with a private corporation, it always fails to get a majority of the business.

Every power system has three essential components: the generating system, the transmission system, and the distributing system. None of these is of any service value without the others as adjuncts; nevertheless the city recently proposed to take over forty-five per cent of the Southern California Edison Company's distributing system at a value below its actual cost to reproduce.

"Severance damage" is a term apparently new to the proponents of the city's project. Let us suppose that any or all of the other communities served by the Southern California Edison Company should also decide to condemn a portion of the company's distributing system piecemeal, would there be any severance damage when the company was deprived of all but a handful of consumers, but still retaining a complete generating and transmission system with a readiness to serve to their full capacity?

As an analogy, let us suppose that one of our great daily papers, circulating extensively in Los Angeles and every other town and hamlet in Southern California, should suddenly find itself deprived of the privilege of doing business in Los Angeles City, what would become of its circulation and advertising? Its entire plant and equipment would be practically valueless as a revenue producing unit. We may carry the analogy still further. At a time not very remote, Los Angeles had a daily municipal newspaper. It was well managed. None of the other papers could compete with it in cost to subscriber. It was voted in as a popular necessity. It went out unlamented by a single taxpayer. It was a useless duplication and a needless expense to the citizens. Its functions, being purely local in character, have at all times been taken care of by the privately-owned newspapers merely as incidental to a complete news service.

It has been stated that it is the duty of the city to distribute the power which it will generate. One of the illusions is that duty and desire are synonymous terms. It was the duty twelve years ago to permit the introduction of a second telephone system in Los Angeles. Now, that we have two efficient systems, but higher rates, it becomes a duty to seek to destroy one of the companies by enforcing inter-change of service. Duplication is a duty in one case, a desire in the other. Duplication has never yet been known to offer a reduction in cost to serve. Every unnecessary pole erected in Los Angeles must ultimately be paid for through the customer's meter or by direct taxation.

REPORT ON THE COLUMBIA RIVER POWER PROJECT.

BY L. F. HARZA.

Appendix G—Problem of Flood Control.

Controlling conditions. Under the scheme of head control which has heretofore been assumed, the headwater would be controlled during moderate floods to greater, but during extreme floods to less, than natural elevation. It is therefore established that any scheme of control dam must include a provision for opening it by gates or otherwise, to a capacity of not less than that of the present natural flood cross section at the damsite.

The location tentatively chosen for the control dam; i.e., the bench to the right of the neck at the head of Five Mile Rapids, is now subject to overflow during floods, as may be seen by a comparison of the flood profiles in Fig. 21 (p. 34, Jan. 8, 1916, issue this journal), with the elevations in the topographic map,

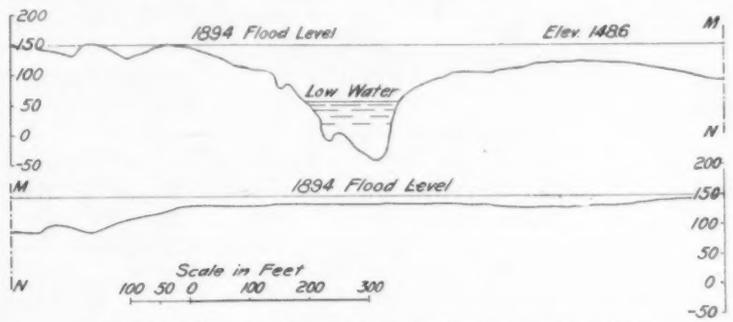


Fig. 33. Cross Section at Damsite during Flood of 1894.

Fig. 9, (p. 394, Nov. 20, 1915, issue). In Fig. 33 is shown a section taken along an irregular route across the river valley, believed to be essentially the natural flood controlling or minimum cross section at the damsite. The total area of cross section during the 1894 flood along this profile was 83,000 square feet, the average velocity therefore about 14.1 ft. per second.

The fall which might be utilized in the passing of floods is limited to the natural fall from the headwater to the place of return of the flood channel to the natural stream bed. In Fig. 7 (p. 394, Nov. 20, 1915, issue this journal) was shown the general proposed layout and in the main channel at or near the upper and lower limits of return of the proposed flood channel are shown two gages, Nos. 2 and 3 respectively. The positions of these gages are also shown in Fig. 21, from which it will be seen that a drop, in 1876 and 1894, of 12 ft. is indicated between the upper river and Gage 2, and in 1903 a drop of 14 ft.

The mean velocity of 14.1 ft. per second in 1894 is represented by a head equivalent of only 3.1 ft. The hydraulic efficiency of the natural channel is therefore very low. This is due to two reasons: The comparatively shallow depth of flow across the rock bench together with its extreme roughness and intersecting cliffs of lava flows, causes a relatively low velocity as compared with that in the main channel. Its fall of 12 ft. is thus largely used up in friction and the correspondingly large velocity thus necessary in the main channel must require the sacrifice of a greater head. These heads of 12 and 14 ft. correspond to velocity equivalents of 28 and 30 ft. per second respectively. Deducting for the portion of this drop which represents friction loss, it is probable that a velocity of at least 20 ft. and perhaps 25 ft. per second, corresponding to theoretical heads of 6.25 ft. and 9.7 ft., exists in the main channel during floods. The artificial flood channel which would be cut through the right bench would be much more efficient hydraulically and would not for this reason require the entire cross section of 83,000 sq. ft.

Available head. The head which can be utilized was determined by the method shown in Fig. 34, most of the data for which was taken from Fig. 21. The upper curve is the relation curve of discharge and elevation at the damsite as determined by the Corps of Engineers, U. S. A., at Gage 1, shown in Figs. 7 and 9 (their Gage No. 3); the next two curves which run together for high discharges essentially represent the water elevation at the point of return to the natural river bed of the artficial flood channel, the position of these gages being also shown in Fig. 7. It was proposed to design the flood channel for a discharge 20 per cent in excess of that of 1894, or 1,400,000 second feet, without increase of headwater elevation above that of 1894. The upper curve is therefore extended horizontally from "B" to "C," Fig. 34, permitting artificial regulation of headwater along a line such as "AC." The curve of Gages 2 and 3 has also been extended to 1,400,000 second feet. The difference in elevation between Gage 1 and Gages 2 and 3 at this point is 8.1 ft., which has been further reduced to 7 ft. for safety; and this figure has been assumed as the

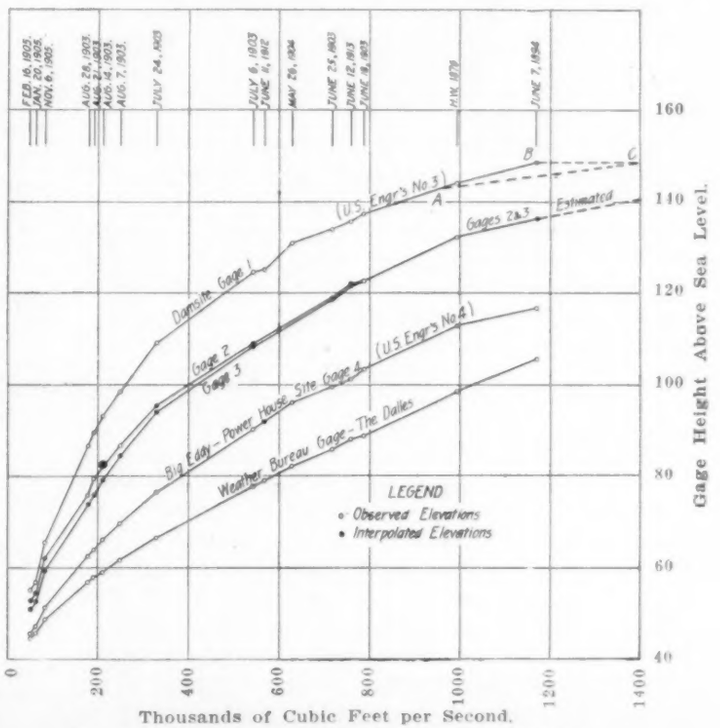


Fig. 34. Gage Curves Through Five Mile Rapids and at The Dalles.

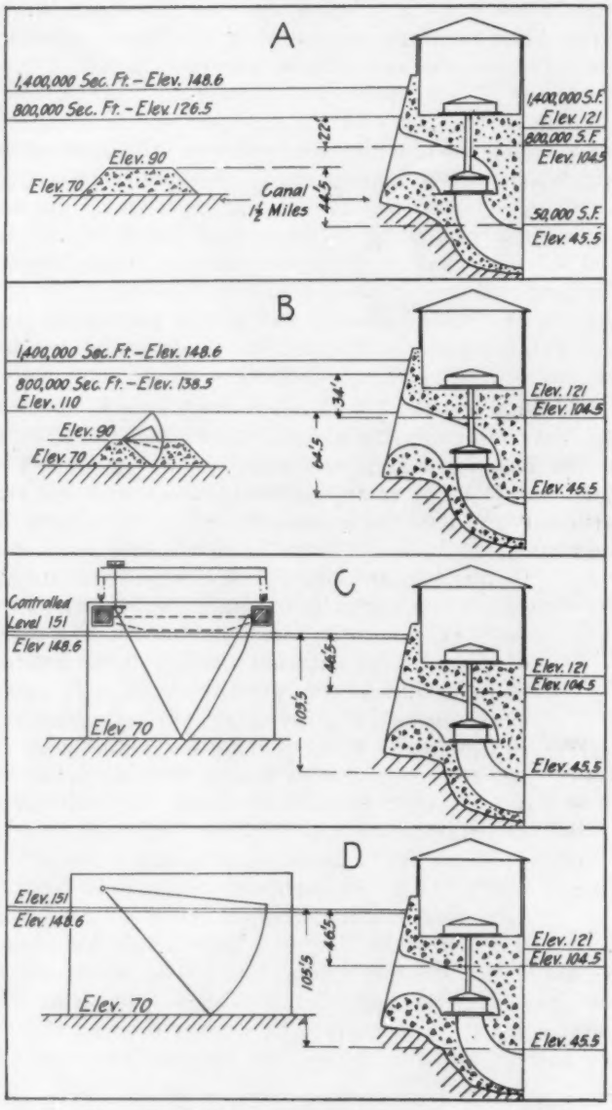


Fig. 35. Alternative Schemes of Development Based upon a Loose Fill Dam.

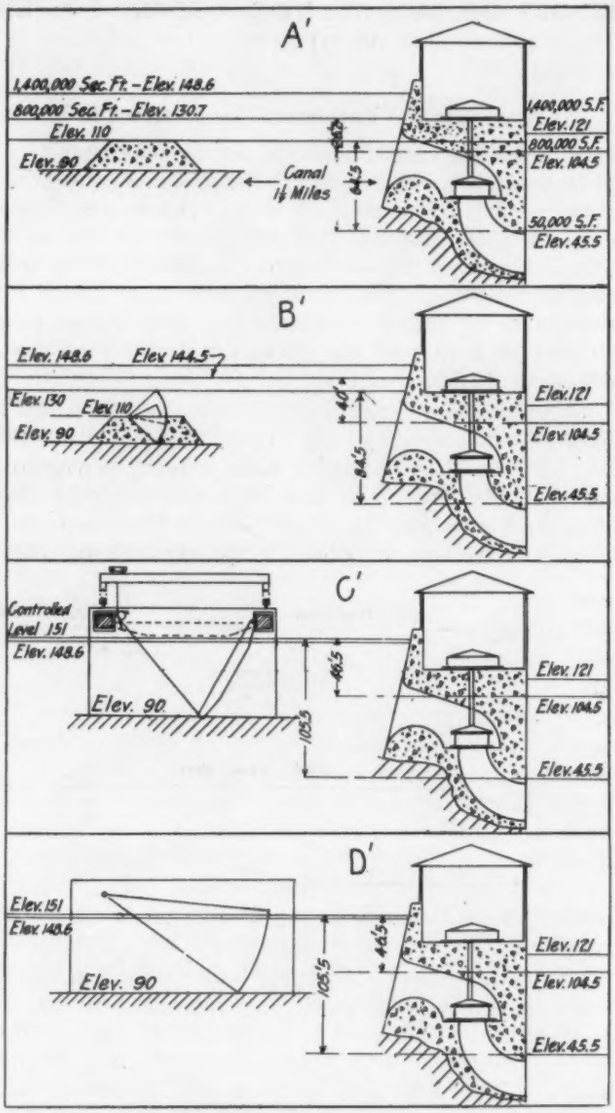


Fig. 36. Alternative Schemes of Development Based upon a Concrete Dam with Gates along the Crest.

available head for the design of the spillway or flood channel.

Alternative projects. The available head has been discussed in its relation to property damage and turbine operation. It is also influenced by the space available for spillway or flood channel and the limitation of feasibility as to both type and size of flood gates. Figures 35 and 36 represent the possible alternative projects as limited by the last named considerations, the former showing the available heads based upon the use of a rock fill dam and the latter upon a concrete dam and the use of its crest for flood gates identical to those used elsewhere.

The first natural assumption is to use, if possible, an overflow spillway designed to pass the maximum flood at the same elevation (148.6) as in 1894. The use of an overflow spillway or weir would require the excavation of a deep flood channel similar to that shown in Fig. 7 and the spillway dam would then be built along the bottom of this channel from the rock fill dam (or across the concrete dam) along the right or Washington shore of the natural river channel until it would meet the wall of the power canal, thus using all available space. A portion of this spillway is shown dotted in Fig. 7 to indicate its location.

The next natural alternative worthy of consideration consists in the use of some form of collapsible crest or "flashboard" on the top of this overflow spillway, to be lowered in time of flood. Such a crest was designed having a height of 20 ft. and is shown in projects B and B'.

The hydraulic conditions are so unusual as not to permit of the accurate design of this spillway for want of experimental data. It would be a submerged weir placed at an angle with the direction of flow, having a fall across its crest of only 7 ft. and a depth of flow in flood time for project A, with rock fill dam, of about 60 ft. and for project A', or with concrete dam, of about 40 ft. The controlled headwater elevations and available heads shown in Figs. 35 and 36 and given in the following table, must therefore be considered as only approximate:

Table of Available Heads.

	At 50,000 Sec. Ft.	At 800,000 Sec. Ft.
Overflow weir, rock fill dam, Project A, Fig. 35	44.5 ft.	22.0 ft.
Overflow weir, concrete dam, Project A', Fig. 36	64.5 ft.	26.2 ft.
Overflow weir, with 20 foot regulating crest and rock fill dam, Project B.....	64.5 ft.	34.0 ft.
Overflow weir, with 20 foot regulating crest and concrete dam, Project B'.....	84.5 ft.	40.0 ft.

An overflow spillway is undesirable in that it does not permit of head regulation during moderate floods. The elevation of crest must be chosen to pass the maximum flood of 1,400,000 second feet without exceeding its natural elevation and useful head is therefore sacrificed at or below the assumed limit of practical operation or 800,000 second feet. This sacrifice at 800,000 second feet is as follows:

Project A.....	22 ft.	Propect A'.....	18 ft.
Project B.....	10 ft.	Project B'.....	4 ft.

Flood gates. It is therefore highly desirable that a dam of some form be constructed such that no sacrifice of available head at any stage of the river will be required. Such a dam must necessarily consist of flood gates which when closed, will hold the water up to the limit of practicable head as governed by other considerations, and when opened will pass the assumed flood of 1,400,000 second feet without exceeding the elevation of 1894, or 148.6 ft. at the damsite.

Such gates require long piers, and much of the already small available head would be lost in turning the water through an angle of about 60 degrees, as would be necessary if the gates were to be arranged along the right shore of the channel in the same position as shown in Fig. 7 for the overflow spillway. The gates have therefore been arranged across the available width in a direction nearly at right angles to the direction of flow. Two chief designs of headworks have been made, each maintaining the head under complete control at all times, one by the use of the Camere vertical girder (sometimes called wicket girders) type of gates and the other by a reversed tainter gate. These are shown in Fig. 35 and 36 as Projects C, C', and D, D'. respectively. The two types of gates and headworks will be described in the order of their development.

(To be continued.)

Concatenation of motors is now used to reduce the speed of the electric towing "mules" at the Panama Canal from two to one mile per hour. Switches have been installed so that the two main induction motors of each locomotive can be operated in cascade at half the speed for which the machines were designed.

Cobalt plating seems destined to replace nickel plating for many purposes, particularly as it offers greater resistance to corrosion, gives a harder surface and can be deposited much more rapidly, due to the higher concentration and conductivity of the solution. A solution of cobalt sulphate with sodium chloride and boric acid on a cobalt plate can be deposited in one minute as compared to one hour required for nickel.

An electric house heating system has been devised in Sweden whereby a four to a ten room house can be economically heated with off-peak electric power. The house is equipped with the ordinary type of hotwater radiator. Resistance elements in a large heat-insulated tank in the attic bring the water to a high temperature during the night. The hot water flows by gravity through the radiators and piping to a tank in the basement, whence a motor driven centrifugal pump forces the water to the tank in the attic, and the cycle is again repeated.

Vacuum melting of silicon steel increases its ductility and improves its magnetic properties, giving high permeability and low hysteresis loss so that it is well adapted for electrical machinery. Full details are given in Bulletin No. 83, Engineering Experiment Station, University of Illinois.

Ocos loses its electric plant as the result of salving the old Kosmos liner Sesostris, which was beached on the coast of Guatemala near Ocos about nine years ago. The chief engineer, who had been left in charge of the ship, supplied electric power to the town from the ship's dynamo. But since the war, prices for steamships have advanced to such a point that it now appears profitable to dig a canal and float the boat back to the sea.

Feed water heaters utilize exhaust steam to raise almost to boiling temperature the water feed to steam boilers, thus preventing the introduction of cold water into the boilers. With the open type of heater the steam is passed directly through the water, while with the closed type the steam passes around circulating water pipes. With the open type the boiler feed pumps are placed between the heater and the boiler while with the closed type they are placed before the heater, thus forcing the water through the heater to the boiler. When the escaping gases from the boiler furnace pass around the feed-water pipes this form of heater is known as an economizer.

Undeveloped potential water power in the United States, according to careful estimate recently presented before the public lands committee of the House of Representatives ranges from 28,000,000 to 35,000,000 h.p. On a basis of 28,000,000 potential h.p. the Government has divided it into groups and states as follows: North Atlantic states, 2,200,000 h.p., or 7.9 per cent; South Atlantic states, 2,300,000 h.p., or 8.2 per cent; the North Central states, 1,700,000 h.p., or 6 per cent; the South Central states, 1,500,000 h.p., or 5.3 per cent; the Western states, 20,400,000 h.p., or 72.6 per cent. This includes the potential horsepower for navigable streams as well as non-navigable streams.

A city's right to nullify a franchise has been affirmed by the U. S. Circuit Court of Appeals at San Francisco. This affirms the decision of the District Court of Washington in the case of the Old Colony Trust Company against the city of Tacoma. The lower court decided the municipality had a constitutional right to nullify a franchise that had been given to the Tacoma Railway and Power Company. The Old Colony Trust Company was trustee for the bondholders of the power company. In 1905 a franchise for twenty-five years was granted to the power company to sell electricity for heating and power purposes. The privilege of selling power for lighting was not given. In 1913 the Tacoma Railway and Power Company, according to the municipality, entered into a contract with the Northern Pacific Railway Company to supply light. When the power company refused to rescind the contract, the Tacoma city council ordered the franchise revoked on the ground that its provisions had not been observed. The Old Colony Trust Company appealed.

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Isolated Hydroelectric Plants

The leading article of this issue is apparently an argument for the construction of isolated water power plants supplying electric energy for mining and industrial purposes, rather than depending upon central station supply. Such a condition already exists in Norway and Sweden where most of the developments are small capacity, low head plants.

Yet close analysis demonstrates that these are exceptional conditions which do not conform to the conditions usually found in the West. Long distance mies in operation that it is seldom possible for the isolated plant to compete. Here and there in inaccestransmission lines can be so easily constructed and centralization of power supply affords such econosible places where the power can be consumed close to the point of generation a mine or manufacturing plant can best afford to generate its own power, but in the great majority of cases purchased central station power is either cheaper, more convenient or otherwise more satisfactory. The choice of these methods represents a nice problem in engineering judgment.

Electrical House Heating

Strong claims are being advanced for electricity as an agent for heating buildings. A number of working installations have been made in localities where surplus power is available during the period of non-irrigation which closely coincides with the period of greatest cold. The most notable instances are on the Minidoka project of the U. S. Reclamation Service in Idaho, where 2200 volt current is supplied between the first of September and the end of May at one dollar per kilowatt per month, based on the maximum demand for the month.

Notwithstanding the cold winter this exceedingly low rate makes it possible to heat homes and even public buildings with electric heaters almost as cheaply as with coal. Thus the high school at Rupert is heated by air forced through eleven grid resistance units consuming 400 kw. at 440 volts. This installation was designed to heat twenty thousand cubic feet of air per minute from zero to seventy degrees Fahrenheit. The high school at Burley is similarly equipped with grids requiring 762 kilowatts. While the current for these installations costs about fifteen hundred dollars annually, as compared with about one thousand dollars for coal, the saving in operator's wages and building space, the longer life and the greater cleanliness and convenience compensate for the difference.

Much the same conditions exist elsewhere throughout Idaho, likewise in the San Joaquin Valley of California. Due to the fact that electric service for irrigation is not required during the winter months the large surplus of electric energy can be used for heating at a price which the consumer can well afford to pay, as otherwise the company would receive no revenue during the months of no demand.

This, at best, is but a temporary expedient. Within a short time other more valuable uses for the current will be developed in these districts. These higher uses will take precedence over the wasteful use of current. At such prices railway electrifi-

cation becomes possible, electro-chemical plants are developed and gradually this sort of electric heating will be replaced by the systems which utilize and store off-peak current. For these latter systems there is a great future. Heat energy can be stored where the storage of electric energy is not an economic possibility. Ultimately this economic question will be solved by the great law of supply and demand.

The Importance of Plain Writing

Little do engineers realize how many promising careers have been limited to mediocrity because of inability to clearly and forcibly express thoughts by word of mouth or pen. How often does it become necessary for a man to impress his ideas on other men. How frequently, at such times, do engineers find themselves unprepared and forfeit to men of less technical ability, but with greater power of expression. Then is a ready command of the English language indispensable.

It is a sad anomaly that those who have done so much to facilitate communication, whether by railway, telegraph or telephone, should usually be unable to adequately communicate their thoughts to others. Few recent technical graduates can write a letter without making mistakes in spelling and punctuation. Fewer still can write an engineering specification without slavishly copying a set form which, likely as not, perpetuates errors perpetrated by the original writer. The same criticism applies to the preparation of engineering reports.

The responsibility for these deficiencies rests primarily upon the engineering college, where English is neglected in order that more time be available for premature specialization in subjects which the student may never be called upon to apply in practice. Even where instruction in English is prescribed most of the course is devoted to a study of the history of literature and a consideration of poetry instead of teaching the student how to write and talk plain prose. Accurate thinking requires plain writing for its expression.

Yet those whose early education has been neglected in this respect can remedy their defects if they will. The power of written and oral expression, like muscular development, can be acquired by anyone who will try. Like a muscle, it is strengthened by use. Constant practice is all that is necessary.

Writing about what you have done makes you better able to do it again. It clarifies your thought and points out where you are weak. Furthermore the publication of such experiences is the greatest service that can be rendered brother engineers. Mutual interchange of experience is the greatest aid to efficiency and the best preventive of the waste that comes from useless duplication of effort. Think of the time that has been spent in trying to accomplish the impossible —to square the circle and to trisect an angle with rule and compass—because the man who had demonstrated the impossibility either could or would not tell the world.

In fact, the lack of public appreciation, about which engineers complain, is largely due to their failure to take the public into their confidence. This is often as much due to unwillingness as to inability. The engineer is too prone to jealously guard what he imagines are secrets, whereas if there is any truth in them they are rightfully universal property. The possession of knowledge is a stewardship which can be met only by sharing it with others.

If the engineer would be appreciated he must tell the public of his deeds which are worthy of esteem This implies neither rushing into print nor indiscriminate talking. It presupposes something to talk about. "The steam that blows the whistle never turns the wheel." Yet whistles have not yet been relegated to the limbo. If the engineer does not blow his own whistle when he has something to blow about, nobody else will blow it for him.

Finally we can be of greater service by honestly telling each other of our failures and learning the lessons from the mistakes than by writing only about our successes. The red flag of danger is as necessary as the green flag of safety. The truly broad man learns from the mistakes of others and is willing that others should learn from his.

An Improved Water Power Bill

While the substitute for the Ferris Bill, as reported by the Senate Public Lands Committee, represents a great improvement over the impossible bill that recently passed the House of Representatives, it is still in need of certain amendments to make it equitable, a few changes to assure the possible investor of the security of his investment. Two defects are so marked as to call for detailed discussion.

One objectionable provision, as it appears in the seventh section, limits contracts for the sale of electrical energy to a period "not to exceed twenty-five years." This is entirely too short a time for the building up of an irrigation project dependent upon the cost of electrically pumped water, or even to justify the establishment of a great manufacturing plant and its workingmen's homes. This is a question which should be left to the lessee, the public service commission and the Secretary of the Interior.

The other objection appears in the eighth section and constitutes the most serious fault in the bill. It gives the Secretary of the Interior the power to specify the rental of federal lands necessary for power development. This discretionary power is capable of abuse and tends to destroy confidence among investors. The charge should reasonably be limited to a fair rental of the land for all purposes and certainly should not exceed twenty-five cents per horsepower year for the power developed and sold by the lessee.

Aside from these two great defects, in one of which the bill is too specific and in the other too general, half a dozen minor amendments should suffice to convert this measure into one which would encourage the development of water power in Western states. While it falls short of placing a premium on hydroelectric development in order to prevent needless fuel consumption, it is so much better than the present onerous restrictions that it would be hailed with joy in the West.

The most notable feature of the bill is its recognition of the necessity of "co-operation between the states, which control the water, and the United States government, which owns the land."

PERSONALS

S. B. Clark, underground engineer Northwestern Electric Company, of Portland, is at Spokane.

F. B. Johnson has been appointed safety engineer for the Pacific Light & Power Corporation of Los Angeles.

F. H. Leggett, Pacific Coast manager Western Electric Company, is spending a few weeks at Seattle.

F. J. Somers of the Century Electric Company of San Jose spent the latter part of the week at San Francisco.

W. S. Graham, manager of the Snow Mountain Power Company at Ukiah, Cal., was at San Francisco last week.

C. V. Schneider of the Electric Supply Company of Sacramento, spent the latter part of the week at San Francisco.

Chas. S. Northcutt, manager of the Modesto Gas Works of Modesto, was a recent business visitor at San Francisco.

I. W. Alexander, editor of the San Joaquin Light & Power Company's magazine, was a recent visitor at San Francisco.

Eph. Doherty, traveling salesman of the American Electric Heating Company of Detroit, Mich., is at San Francisco.

A. K. Baylor, administrative official of the General Electric Company of Schenectady, has returned to the East after spending a couple of weeks on the Coast.

Guy Talbot, president Pacific Power & Light Company, is at New York and Washington, where he will remain about a month.

Kelley Courtwright has succeeded **J. H. Carr,** deceased, as manager of the Valley Electrical Supply Company at Fresno, Cal.

Wm. Hood, chief engineer of the Southern Pacific Railroad, was recently made an honorary member of the Engineer's Club at San Francisco.

E. R. Murray, with the Western Electric Company of San Francisco, has just returned to San Francisco after a successful business trip throughout the San Joaquin Valley.

M. L. Joslyn, president of the Joslyn Manufacturing & Supply Company, Chicago, Ill., and president of the Baker-Joslyn Company of San Francisco, is expected at San Francisco about the first of the week.

E. M. Cutting, Pacific Coast manager of the Edison Storage Battery Company, Orange, N. J., has returned to San Francisco after an extended business trip throughout the Sacramento and San Joaquin Valleys.

A. J. Meyers, Pacific Coast manager of the Wagner Electric & Manufacturing Company, has returned to San Francisco after an extended business trip throughout Southern California.

Guy L. Bayley, having practically completed his duties as chief mechanical and electrical engineer for the Panama-Pacific International Exposition, has opened offices as consulting engineer at San Francisco, specializing on industrial problems.

R. T. St. John, for several years associated with the General Electric Company on the Pacific Coast, has resigned to devote his time to personal interests, having recently been elected secretary of the Harbor Building and Loan Association of Southern California, with offices in Los Angeles.

W. D'A. Ryan, illuminating engineer of the General Electric Company, and for the past year illuminating engineer for the P. P. I. E., has recently left for the East on a business trip and while in Boston will give a lecture to the A. I. E. E. on the exposition illumination and its commercial applications.

Representatives of the J. W. Johns-Manville Company from all parts of the United States were gathered at San Francisco for their annual convention during the past week. Among those present were: **H. R. Wardell,** general manager of the roofing department; **B. C. McClure,** general manager of the purchasing department; **E. L. Cox,** general manager of the illumination department; **L. R. Hoff,** general sales manager, all of New York, and **R. W. Wade, W. H. Rumble, Wm. Lichty, H. D. Ainslie, E. T. Bates, W. S. Hennickle, L. Brinker,** and **G. Allen,** representing the sales force of the Los Angeles office; **H. J. Pelleod** of Fresno, **H. K. Takabury** of Sacramento, **C. L. Hill** of El Paso, **Sidney Mayen** of San Diego, and **W. S. Greenfield,** Pacific Coast manager at San Francisco, who presided at the convention. More than forty San Francisco salesmen and other representatives were also in attendance.

A dinner was given at the Clift Hotel on last Friday evening in honor of **W. M. Shepard,** before he left the employ of the General Electric Company at San Francisco, for the North to assume his new position as commercial agent for the California Oregon Power Company. Those present were:

Camp, W. E.	King, L. S.	Mixer, R. C.
Delehanty, W. J.	Van Huysen, J. W.	Gallagher, H. J.
Sievers, F. O.	Boyd, F. E.	Harraden, W. L.
Loring, C. A.	Fagan, F. D.	Ross, C. V.
Kinney, G. I.	Hunt, E. A.	Fulton, A.
Alvord, R. M.	Hixson, M. C.	Sage, W. C.
Shreve, E. O.	Kearney, S. E.	Lamgor, J. J.
Dennis, A. R.	Thompson, A. V.	Kenyon, R. E.
Hood, J.	Paterson, F. W.	Gibson, E. P.
Stanley, H. C.	Davis, Jr., W. J.	Shepard, W. M.
Johnson, C. B.	Jones, A. G.	Heinrichs, M. A.
O'Harra, W. E.	Schnapp, M. H.	Voyer, L. E.
Rhine, M.	Myers, E. C.	Hamilton, F. G.
Gassaway, S. G.		

OBITUARY.

William Woodford Cott, for some time sales manager of the Edison Lamp Works of the General Electric Company at Los Angeles, succumbed to typhoid fever on January 5th at Nashville, Tenn., where he had been associated with the company in a similar capacity.

NEW CATALOGUES.

"A Stitch in Time" is the subject of a readable booklet from James G. Biddle, instrument maker, of Philadelphia, which explains the use of the megger in testing insulation resistance.

Switchboard Structural Devices and Accessories are illustrated and described in Bulletin No. 47750 from the General Electric Company. These include standardized supports for switchboards, busbars and insulators, as well as various forms of terminals, clamps and converters.

MEETING NOTICES.

Los Angeles Jovian League.

The regular weekly meeting of the Jovian Electric League was held at Christophers' Wednesday, February 2d. The program was under the direction of B. F. Kieruliff, Jr., president of The B. F. Kieruliff Company, who was chairman of the day. After the introduction of guests, and the levying of fines against absent-minded members without badges, the speaker of the day, Theo. D. Ranouse, was introduced. His subject, "An Old Man's Dream," dealt with reminiscences of his early childhood, ending with a present-day prophecy of a world-wide peace, through the agency of efficient preparedness. The "Four Apollos," a male quartet, with considerable musical ability, completed the program with a number of entertaining selections. A big Jovian rejuvenation is planned for February 18th, and the various committees are working over-time to make the affair a huge success. The wandering satellites of the various electrical industries without the fold are being gathered together, and a record class is assured.

San Francisco Electrical Development and Jovian League.

The February 2d lunch was another capacity house, as is the rule now-a-days. President Cutting was in fine fettle and the meeting proceeded with dispatch. In response to Mrs. M. C. Sloss' plea that the league members co-operate in the "dollar day" collection for the Associated Charities on February 14th, this movement was unanimously endorsed. R. F.

Behan was then introduced as chairman of the day and purveyor of entertainment. The last came first in the form of much appreciated musical selections. Then J. J. Jackson, general attorney for the Westinghouse Electric & Manufacturing Company, after paying tribute to the pioneer spirit which built the West, gave an inspiring talk on prosperity, not based on temporary war business, but due to our splendid advantage among nations. The war business, however, has taught the wisdom of a man's sticking to his own business. The war, likewise, and France in particular, has taught the lesson of thrift and the necessity for a strong middle class. At the conclusion of the talk Mr. Jackson, as well as Mr. Behan, was given a riging vote of thanks.

Portland Sections A. I. E. E. and N. E. L. A.

The bi-weekly luncheon Thursday, February 3, at the Portland Commercial Club, was opened by a prize contest in which L. R. Elder of the General Electric Company made the nearest guess as to the number of water horsepower filed upon by utilities in Oregon, as shown by the state engineer's records. Mr. Elder guessed 450,000, the actual figures being 456,410 h.p. The record guess on the number of h.p. in Multnomah county was also won by Mr. Elder, with 100 h.p. actual figures being 88 h.p. The prize was an electrical percolator.

Mr. George Purvis of the Hurley Machine Company of Chicago gave a general talk on Electric Washing Machines. He also told how his company always had used the follow-up system and sent out a postal card every nine months to all their customers asking for suggestions how they could improve their machine. They received replies from 10 per cent of the people the inquiries were sent. He also said the best class of customers was in the family where one servant was employed or where the lady of the house did her own work.

Mr. W. L. Goodwin, general sales manager of the Pacific States Electric Company, talked upon "Co-operation as practiced in California between manufacturers, contractors, jobbers and central stations." In this talk Mr. Goodwin told of his experiences in California during the time he was trying to inaugurate the system and the results he had accomplished. In Oregon, there seems to be no such co-operation. "Co-operation is absolutely necessary to preserve the industry for electrical people." The small manufacturer of specialties was generally willing to place his wares in the department stores, hardware stores, and 5, 10 and 15 cent stores, which was absolutely demoralizing in its effect. Attendance 45.

NEWS OF THE IDAHO PUBLIC UTILITIES COMMISSION.

In the matter of the application of the Potlatch Electric Company for approval of its schedule of electric rates in Kendrick, Idaho, the commission tentatively approved the rates.

TRADE NOTES.

Swift & Company will construct a plant at San Diego, Cal., for the production of potash from kelp.

The Wagner Electric Manufacturing Company of St. Louis announces the opening of a new office in the Mills Building, El Paso, Texas, with F. B. Hitchings as local manager. This new office is under the supervision of O. H. Davidson, district manager of the Wagner Company, whose headquarters are in Denver.

Rice culture in California may soon receive a big impetus, as the Department of Agriculture has decided to co-operate with the California State Water Commission during the approaching irrigation season in the study of the possibilities of extending rice growing in the Sacramento Valley. Experimental work is to be conducted near Woodland, Knights Landing, Princeton, Gridley and Biggs.

The Bureau of Supplies and Accounts, Navy Department, Washington, D. C., will receive bids until February 21, 1916, for one 37½ kw. 250/2500 volt motor generator set with switchboard and accessories to be delivered at the navy yard, Mare Island, Cal., consigned to supply officer, naval station, Guam, P. I., also three 2 k.v.a. 2200/110 volt oil-cooled transformers, two triple pole, graded shunt multi-gap lightning arresters and six 50 ampere choke coils, one 56 cell storage battery.

A list of generators and motors that are to be installed at the Hawley Pulp & Paper Mill, Oregon City, Oregon, by the General Electric Company, include a 937 k.v.a., 2300 volt, 3-phase generator; 16 kw., 125 volt, d.c. exciter; bank of three 100 k.v.a. transformers, primary 11,000 volt, secondary 2300 volt; 150 h.p., 3-phase, 2200 volt induction motor; 75 h.p., 2200 volt, 3-phase induction motor. To a bank of 3-50 k.v.a. transformers, primary voltage 2300, secondary 480. From secondary side of 350 k.v.a. transformers, primary 2300, secondary 480 to distributing panel. From distributing panel to 25 h.p., 440 volt, 3-phase induction motor; 22 h.p., 3-phase, 440 volt motor crane rating; 15 h.p., 3-phase, 440 volt induction motor; 5 h.p., 440 volt, 3-phase motor; 333 kw., 265 volt, d.c. generator, to 400 h.p., 260 volt, d.c. motor; 14 kw., 250 volt, d.c. exciter.

ORGANIZATION OF THE LIGHTING BUREAU COMMERCIAL SECTION NATIONAL ELECTRIC LIGHT ASSOCIATION.

Two most enthusiastic meetings of the recently organized Lighting Sales Bureau have been held. This Lighting Sales Bureau was established by the executive committee of the commercial section of the National Electric Light Association, Mr. John G. Learned of the Public Service Company of Northern Illinois, having been appointed chairman. The first meeting was held in Chicago in December, and the second in New York, January 11, 1916. This bureau is planning to carry on work of exceedingly practical value in the promotion of lighting sales of member companies. Its reports and its recommendations will be along practical sales lines, the thought being to help member companies to learn the experience of other companies in the promotion of the lighting business. The work of the Bureau is divided among several committees as follows:

Residence Lighting Committee, F. H. Scheel, Streator, Ill., chairman.—This committee intends to cover this subject at the coming convention in Chicago from the standpoint of securing additional residence customers from new buildings as well as existing buildings.

Advertising Committee, A. K. Young, Toledo, Ohio, chairman.—This committee covers the entire field of display lighting, including flood lighting, store front, outline, roof signs, billboard and bulletin board lighting.

Stores and Public Buildings Committee, S. E. Burrows, Newark, N. J., chairman.—This committee is studying the very important subject with the object of outlining plans for securing additional store and public building lighting.

Municipal and Highway Lighting, Thomas F. Kelly, Dayton, Ohio, chairman.—This important committee will hold a meeting in Cleveland on Friday, January 28th.

Industrial Lighting Committee, O. R. Hogue, Chicago, Ill., chairman.—Mr. Hogue is planning to compile a code of industrial lighting covering small standard lighting units which can be used in this class of work. Mr. Hogue's successful campaign in Chicago, in which he has used standard units of this kind will be reported in full. This code will contain selling arguments for the lighting salesman. It will give data and statistics regarding improving the health and efficiency of employes, the reduction of accidents in industrial plants and the far-reaching effect of good industrial lighting upon the homes of industrial workers.

NEWS NOTES

ILLUMINATION.

BISHOP, CAL.—Bids have been called for the installing of lights in the Lone Pine Lighting District, which was recently established.

RED BLUFF, CAL.—Sealed bids will be received up to February 16th for installing a lighting system on Main street between Hickory and Elm streets.

BAKERSFIELD, CAL.—A. E. Stegeman has completed a survey for a pipe line which the California Natural Gas Company is to extend from Waits to the Kern River Oil Fields and work is to start immediately.

WALLA WALLA, WASH.—J. Davidson, vice-president of the Pacific Power & Light Company, has announced that improvements will be made to the power plant and that continuous electric service will be furnished in the future.

PERRIS, CAL.—A contract for installing 26 additional lights in different parts of the city has been signed. C. F. Backstrand of the Southern Sierras Power Company says the work will be started as soon as the weather will permit.

LOS ANGELES, CAL.—Sealed bids will be received by the board of supervisors up to February 14th for maintaining the system of street lighting in the Bairdstown Lighting District, in accordance with specifications on file with the board.

MARTINEZ, CAL.—Announcement has been made by the Contra Costa Gas Company, that service is to be extended to towns along the water front. On April 1st the company will begin laying mains to supply gas to Port Costa, Crockett and Valona.

TAFT, CAL.—The Kern Trading & Oil Company has completed its 16 mile gas line from the 1 camp on Sec. 1, 32-23, to the McKittrick district. The line is to supply the high thermal unit gas of the Midway to the various leases of the K. T. & O. in the McKittrick field for light as well as fuel, and is also to be used at the pumping stations of the Associated Pipe Line Company.

SAN FRANCISCO, CAL.—The board of supervisors has endorsed the proposed system of lighting Market street. The only drawback to the plan was the refusal of the finance committee to appropriate more than $10,000 as the city's share of the expense. The Downtown Association, which is responsible for the campaign for better lights for Market street, asked that the supervisors appropriate at least $14,000 of the $23,194 necessary for the installation and upkeep of the new system.

TRANSMISSION.

SEATTLE, WASH.—The city council voted to develop the Sauk-Suiattle power site, in the government forest reserve, for auxiliary electric power.

HELENA, CAL.—Announcement has been made by F. M. Kerr of Butte, general manager of the Montana Power Company that as soon as possible a preliminary survey will be made looking to the construction of the Holter power plant. Its construction will require 300,000 yards of masonry and 1500 tons of steel. The dam and power plants will cost from $3,000,000 to $3,500,000.

AUBURN, CAL.—Another condemnation suit instituted by the Pacific Gas & Electric Company for its proposed new tower line through this county is under way in the Superior Court. The defendants are George Campbell and William Campbell. This suit will be followed by several others. The company is prosecuting such suits in Placer, Sacramento, San Joaquin and Solano counties. Its new tower line will extend from here to San Francisco Bay, where rights of way have been secured.

TRANSPORTATION.

SPOKANE, WASH.—The Spokane Traction Company will accede to the wishes of persons in the northwest section of the city who desire the building of a line from Boone avenue to Broadway on Madella street, if the consent to the construction is granted by the company in Portland, and if the city council grants a franchise.

PASADENA, CAL.—A short line transportation service between Pasadena and Los Angeles is under consideration. Plans will be presented to the city commission and the Pacific Electric Company. The plan is to extend the North Loop track from the present terminus at East Orange Grove and Allen avenues, to connect with the Sierra Madre line to Los Angeles. The line would not be more than a mile long.

FALLON, NEV.—At the annual meeting of stockholders of the Fallon Electric Railroad the old board of directors was re-elected, consisting of C. A. Hascall, president; H. C. Lattin, vice-president; A. E. Wilson, secretary; E. S. Berney, treasurer and manager; A. Bauman, director. Manager E. S. Berney reported that the grading for the road was practically completed as far as Sand Point, a distance of about 25 miles from Fallon.

FRESNO, CAL.—Construction work upon seven miles of extension of the Fresno Interurban Railway Company will be started immediately, according to Lee H. Landis, who is at the Hotel Fresno. The extension will start from the Barton vineyard and reach to Kutner's Colony. That the company will spend $125,000 in construction work before summer is the declaration of Mr. Landis. Immediately following the extension to Kutner Colony construction work on the line to Clovis will start. This will begin from a point 6½ miles from town on the Kutner Colony branch and the extension will be five miles. This is to be followed by extending the Kutner Colony line on to Centerville, a distance of 12 miles.

TELEPHONE AND TELEGRAPH.

COLFAX, WASH.—The Spring Flat Rural Telephone Company has petitioned the commissioners for a franchise to operate a telephone line from Colfax to the Enos place.

SAN DIEGO, CAL.—An ordinance granting the Postal Telegraph-Cable Company permission to lay its wires and cables along and under certain streets in this city, has been adopted by the city council.

PETALUMA, CAL.—The Pacific Telephone & Telegraph Company intends to spend considerable money in improvements to switchboards, cables, and toll lines in this vicinity. Work has been completed on the Santa Rosa toll lead between San Rafael and Petaluma. Within the next four or five months about $3000 will be expended in the placing of underground cable at the main office, and re-enforcing the present lateral cable at Third and B streets with 100 pair cable. Over 8000 feet of 100 pair cable will be placed on B street; 2500 feet of 50 pair cable on Main street and 800 feet on East Washington street.

Wanted and For Sale

The rate for advertisements in this column is $1.00 per insertion for 25 words or less; additional words 2 cents each, payable in advance. Remittance and copy should reach this office not later than Monday noon for the next succeeding issue. Replies may be sent in care of the Journal of Electricity, Power and Gas, Crossley Building, San Francisco.

FOR SALE.—Big bargains, 8 substation transformers at about half price. Inquire of A. S. Dewdney, 329 E. 18th St., Oakland, Cal.